

Appendix A

Emission Estimates And Major Modification Analysis



Geomatrix

November 4, 2005

Mr. James Cagle
Agrium U.S. Inc.
Conda Phosphate Operations
3010 Conda Road
Soda Springs, Idaho 83276

Re: IDEQ Data Request Response
Fugitive Fluoride Emissions from Gyp Stack Ponds

Dear Mr. Cagle:

On June 20, 2005, Agrium Conda Phosphate Operations (CPO) submitted information responding to a request from Ken Hanna of the Idaho Department of Environmental Quality (IDEQ) regarding a PSD applicability analysis for the proposed increase in CPO's superphosphoric acid (SPA) production limit. Subsequently, Ken Hanna has requested additional information regarding fugitive emissions of fluoride from the gyp stack ponds. This letter provides information responding to Ken Hanna's subsequent information request regarding fluoride emissions.

Fugitive Fluoride Emissions

Gyp is delivered to the gyp stack pond as slurry allowing the gyp to settle. The gyp stack pond water contains fluorides in several chemical forms. An emission factor of 1.6 pounds per acre per day (lb/acre/day) is used to calculate fugitive emissions of fluoride from the gyp stack pond. This emission factor is based on the emission factor presented in Section 5.11 of the 4th edition of EPA's AP-42 documents. The 4th edition provides an emission factor of 1.12 lb/ton of P₂O₅ produced. In a footnote in this same section, a typical equivalent between P₂O₅ production and pond size was given as 0.7 acres per 1 ton of P₂O₅ produced. Using the emission factor and the pond size equivalent, an emission factor of 1.6 lb/ton/day for fugitive emissions of fluoride is used. This emission factor was relied upon in generating the recent gyp stack PTC application submitted on April 29, 2005.

The increase in CPO's SPA production limit does not affect the surface area of the gyp stack ponds since the footprint of the gyp stacks are not increasing. Therefore, the increase in SPA production does not increase fugitive emissions of fluoride from the gyp stack ponds. As detailed within the attached project emission inventory, the difference in fugitive emissions of fluoride is 0 tons per year.

If you have any questions regarding information in this letter, or if you need any additional information, please do not hesitate to contact me at 425.921.4015.

Sincerely,
Geomatrix Consultants, Inc.

Rafe Christopherson, P.E.
Air Quality Engineer

Attachments: Attachment 1: Updated PSD Applicability Analysis

19203 36th Avenue West, Suite 101
Lynnwood, Washington 98036-5772

Tel 425.921.4000
Fax 425.921.4040

www.geomatrix.com

R E C E I V E D

NOV 07 2005

Department of Environmental Quality
State Air Program



Attachment 1

Updated PSD Applicability Analysis

PROJECT-SPECIFIC VOLATILE ORGANIC COMPOUND EMISSION CHANGES					
SOURCE	2002	2003	2004	EMISSIONS PER YEAR (TPY)	
Phosphoric Acid Plant	0.0	0.0	0.0	0.0	0.0
Superphosphoric Acid Plant	0.0	0.0	0.0	0.0	0.0
Boiler B-5	0.8	0.5	0.6	1.2	
Thermal Oil Heaters	0.8	0.6	0.7	0.8	
SPA Oxidizer	0.0	0.0	0.0	0.0	
TOTAL (TPY)	1.22	1.16	1.32	2.15	
DIFFERENCE (TPY)		1.10	0.05		
SIGNIFICANT EMISSION RATE (TPY)			40		

PROJECT-SPECIFIC NITROGEN OXIDE EMISSION CHANGES					
SOURCE	2002	2003	2004	EMISSIONS PER YEAR (TPY)	
Phosphoric Acid Plant	0.0	0.3	0.0	0.3	
Superphosphoric Acid Plant	0.0	0.5	0.0	0.5	
Boiler B-5	20.10	21.56	20.54	56.15	
Thermal Oil Heaters	8.95	8.40	8.20	12.40	
SPA Oxidizer	0.42	0.45	0.48	0.85	
TOTAL (TPY)	30.50	29.92	28.80	67.38	
DIFFERENCE (TPY)	2.52	34.72	33.16		
SIGNIFICANT EMISSION RATE (TPY)			40		

PROJECT-SPECIFIC CARBON MONOXIDE EMISSION CHANGES					
SOURCE	2002	2003	2004	EMISSIONS PER YEAR (TPY)	
Phosphoric Acid Plant	0.0	0.0	0.0	0.0	
Superphosphoric Acid Plant	0.0	0.0	0.0	0.0	
Boiler B-5	12.82	10.99	14.17	28.90	
Thermal Oil Heaters	9.68	9.24	10.25	14.18	
SPA Oxidizer	0.0	0.0	0.0	0.0	
TOTAL (TPY)	22.50	19.62	24.42	40.77	
DIFFERENCE (TPY)		19.72	15.75		
SIGNIFICANT EMISSION RATE (TPY)			100		

PROJECT-SPECIFIC PM10 EMISSION CHANGES					
SOURCE	2002	2003	2004	EMISSIONS PER YEAR (TPY)	
Phosphoric Acid Plant	3.59	3.51	3.42	3.62	
Superphosphoric Acid Plant	1.06	1.13	1.15	2.14	
Boiler B-5	3.43	2.77	3.79	4.42	
Thermal Oil Heaters	0.88	0.84	0.93	1.28	
SPA Oxidizer	0.0	0.0	0.0	0.0	
Ore Storage and Transfer Fugitive Emissions	0.1	0.1	0.1	0.2	
Gyp Stack Fugitive Emissions (including roadway dust)	0.4	0.5	0.5	0.7	
TOTAL (TPY)	8.94	8.84	10.10	12.36	
DIFFERENCE (TPY)		2.77	2.80		
SIGNIFICANT EMISSION RATE (TPY)			10		

PROJECT-SPECIFIC PM EMISSION CHANGES					
SOURCE	2002	2003	2004	EMISSIONS PER YEAR (TPY)	
Phosphoric Acid Plant	3.00	3.51	3.82	3.82	
Superphosphoric Acid Plant	1.08	1.13	1.18	2.14	
Boiler B-5	3.43	2.77	3.79	4.42	
Thermal Oil Heaters	0.88	0.84	0.93	1.28	
SPA Oxidizer	0.0	0.0	0.0	0.0	
Ore Storage and Transfer Fugitive Emissions	0.2	0.3	0.3	0.4	
Gyp Stack Fugitive Emissions (including roadway dust)	1.7	2.0	2.2	3.0	
TOTAL (TPY)	10.69	10.48	11.88	14.99	
DIFFERENCE (TPY)		4.02	3.82		
SIGNIFICANT EMISSION RATE (TPY)			25		

PROJECT-SPECIFIC FLUORIDE EMISSION CHANGES					
SOURCE	2002	2003	2004	EMISSIONS PER YEAR (TPY)	
Phosphoric Acid Plant	2.16	2.47	2.71	3.70	
Superphosphoric Acid Plant	0.20	0.37	0.42	1.00	
Boiler B-5	0.0	0.0	0.0	0.0	
Thermal Oil Heaters	0.0	0.0	0.0	0.0	
SPA Oxidizer	0.6	0.0	0.0	0.0	
Gyp Stack Fugitives	38.5	38.5	38.5	38.5	
TOTAL (TPY)	38.67	38.54	38.63	41.78	
DIFFERENCE (TPY)		2.61	2.30		
SIGNIFICANT EMISSION RATE (TPY)			3		

Phosphoric Acid Plant

Operations			
2002 P2O5 Input (tonnes/year)	2003 P2O5 Input (tonnes/year)	2004 P2O5 Input (tonnes/year)	Projected P2O5 Input (tonnes/year)
320,170.0	365,289.0	401,725.0	560,000
362,728.0 2002-2004 Average P2O5 production, tonnes/year			
2002 P2O5 Input (hours/year)	2003 P2O5 Input (hours/year)	2004 P2O5 Input (hours/year)	Projected P2O5 Input (hours/year)
3,424.0	3,288.0	3,514.0	8,514
3,391.0 2002-2004 Average hours of operation			

Fluoride Emission Factors	
0.9135	lb Fluoride / ton P2O5 feed

Particulate Emission Factors	
0.86	lb PM / hour
0.86	lb PM10 / hour

PM and PM10 emission rates based on 2003 source test results

Annual Emissions			
Pollutant	2002 Annual Emissions (tonnes/year)	2003 Annual Emissions (tonnes/year)	2004 Annual Emissions (tonnes/year)
PM	3.66	3.51	3.62
PM-10	3.58	3.51	3.62
Fluoride	2.16	2.47	2.71
			3.78

Associated Fugitive Emission Sources - Phosphoric Acid Plant

Ore Transfer Point and Storage Emissions

$$\text{Emission Factor} = k[0.0032(Ug)^{-1}(M^2)^{0.7}]$$

Where: k = particle size multiplier (0.74 for TSP & 0.35 for PM10)

U = mean wind speed (mph) = 3.4 mph (annual average of the non-calm wind speeds)

M = material moisture content (%) = 10.5% for ore and 18.1% for coal.

Ore Transfer Emission Factors	PM PM10	0.0001407 0.000665	0.0001407 0.000665
	Ore Usage by:		
2002	1,087,947		
2003	1,244,861		
2004	1,365,073		
Projected	1,902,295		

PM Emissions (t/yr)	2002	2003	2004	Projected
Unload Ore to Storage Pile	0.077	0.088	0.096	0.134
Transfer Ore from Storage to Wash Plant	0.077	0.088	0.096	0.134
Ore Storage Pile	0.077	0.088	0.096	0.134

PM10 Emissions (t/yr)	2002	2003	2004	Projected
Unload Ore to Storage Pile	0.038	0.041	0.045	0.063
Transfer Ore from Storage to Wash Plant	0.038	0.041	0.045	0.063
Ore Storage Pile	0.038	0.041	0.045	0.063

Total Ore Storage and Transfer Fugitive Emissions

Year	PM (ton/year)	PM10 (ton/year)
2002	0.13	0.11
2003	0.26	0.12
2004	0.20	0.14
Projected	0.40	0.19
Difference [2002-2003] - Projected	0.18	0.07
Difference [2003-2004] - Projected	0.13	0.06

Associated Fugitive Emission Sources - Phosphoric Acid Plant

Gyp Stack & Fugitive Road Dust

Backhoes

Emission Factor = $k(0.00032WU)^{1.7}(M/2)^{1.7}$
 Where: k = particle size multiplier (0.74 for TSP & 0.35 for PM10)
 U = mean wind speed (mph) = 3.4 mph (annual average of the non- calm wind speeds)
 M = material moisture content (%) = 40%
 PM EF = 0.0000216
 PM10 EF = 0.0000102

Emissions	PM	PM10	Notes
2002	0.0019	0.0009	
2003	0.0021	0.0010	Estimated based on the ratio of annual ore use vs. projected ore use
2004	0.0023	0.0011	At maximum production, the backhoes will move 1,154 tons of gyp per day, 5 days per week, 52 weeks per year.
Projected	0.0032	0.0016	

Dozer & Compactor

Emission Factor = $\frac{45^6}{W^2} \frac{M^2}{N^2}$
 Where: k, a, b is 5.7, 1.2, 1.3 for PM and 0.75, 1.5, 1.4 for PM10
 s = silt content (%) = 5.1%
 M = material moisture content (%) = 25%
 PM EF = 0.613
 PM10 EF = 0.085

Emissions	PM	PM10	Notes
2002	0.4558	0.0709	
2003	0.5215	0.0811	Estimated based on the ratio of annual ore use vs. projected ore use
2004	0.5719	0.0889	At maximum production, both the dozer and compactor will operate 5 hours per day (one-half of a 10-hour shift), 5 days per week, 52 weeks per year.
Projected	0.7972	0.1239	

Grader			
Emission Factor = kS^2			
Where: k = 0.04, 2.5 for PM and 0.036, 2 for PM10 S = speed [miles per hour] = 5 mph PM EF = 1.118 PM10 EF = 0.383			
Emissions	PM	PM10	Notes
2002	0.1330	0.0465	
2003	0.1521	0.0520	Estimated based on the ratio of annual one use vs. projected one use
2004	0.1869	0.0671	
Projected	0.2359	0.0798	At maximum production, the grader will travel 8 miles per week, operating 52 weeks per year.

Unpaved Roads - Pickup trucks			
Emission Factor = $k(a^2)(W/s)^2$			
Where: k = empirical constant (4.9 for TSP & 1.5 for PM10) a = empirical constant (0.7 for TSP & 0.9 for PM10) b = empirical constant (0.45 for TSP & PM10) s = surface material silt content (%) = 5.1 % W = average weight (tons) of vehicles traveling = 3 tons			
Note: the gypsum is routinely excavated at 40% moisture and compacted at 20% moisture. Watering is routinely applied to the phosphogypsum stock roadsides during construction season to control fugitive dust, and to maintain proper moisture for compaction. A 50% reduction for this activity is applied to the emissions estimate.			
Emissions	PM	PM10	Notes
2002	1.1235	0.2088	
2003	1.2854	0.3316	Estimated based on the ratio of annual one use vs. projected one use
2004	1.4087	0.3637	
Projected	1.6011	0.5069	At maximum production, two pickups each drive 4 miles per day on the drive, 365 days per year for a total of 2,620 VMT per year.

Gyp Stack Fugitive Fluoride Emissions

Emission Factor = 1.6 lbs/acre/day

49th edition of API-42 (Section 5.1)

Emissions	Gyp Stack Pond Area (acres)	Fugitive Emissions (tons/year)	Notes
2002	125	36.5	
2003	125	36.5	Gyp stack pond area is not affected by an increase in production rate. All emissions are calculated based on 305 days per year of operation.
2004	125	36.5	
Projected	125	36.5	

Total Fugitive Emissions associated with the Gyp Stack

Year	Fluoride (tons/year)	PM (tons/year)	PM10 (tons/year)
2002	36.5	1.71	0.41
2003	36.5	1.93	0.47
2004	36.5	2.15	0.51
Projected	36.5	3.00	0.71
Difference (2002-2003 - Projected Difference) (2003-2004 - Projected Difference)	0.00	1.16	0.28
	0.00	0.94	0.22

SPA Oxidation Process

Operations			
2002 P2O5 Input (tons/year)	2003 P2O5 Input (tons/year)	2004 P2O5 Input (tons/year)	Projected P2O5 Input (tons/year)
170,557.3	182,535.6	199,535.4	345,000
188,086 ± 2003-2004 Average P2O5 production, tons/year			
Nitrogen Oxide Emission Factors			
0.0149	1b Nitrogen Oxide / ton P2O5 feed, May 2002 source test		

Annual Emissions			
Pollutant	2002 Annual Emissions (tons/year)	2003 Annual Emissions (tons/year)	2004 Annual Emissions (tons/year)
Nitrogen Oxides	0.42	0.45	0.46

Boiler B-5

Operations		2003 Heat Input (MMBtu/year)	2004 Heat Input (MMBtu/year)	Projected Heat Input (MMBtu/year)
2002 Heat Input (MMBtu/year)	903,127	729,586	987,786	1,872,888

2002 Fuel Input (MMscf/year)		2003 Fuel Input (MMscf/year)	2004 Fuel Input (MMscf/year)	Projected Fuel Input (MMscf/year)
	903,127	729,586	987,786	1,872,888

Conversion Factors

45.9 therm, heat input required for each ton of P2O5 feed that goes to SF-A plant
100,000 btu per therm
1000 btu per scf gas

Emission Factors

Pollutant	Emission Factor ^(a)
NOx	0.0578 lb/MMBtu
CO	0.0284 lb/MMBtu
SO2	0.80 lb/MMscf
PM	7.80 lb/MMscf
PM-10	7.80 lb/MMscf
VOC	0.0013 lb/MMBtu

Nox, CO, VOC emission factors from June 2005 source test.

All other factors from AP-42 Natural Gas External Combustion

Annual Emissions

Pollutant	2002 Annual Emissions (tons/year)		2003 Annual Emissions (tons/year)		2004 Annual Emissions (tons/year)		Projected Annual Emissions (tons/year)	Existing Permit Limits (pounds/hour)	Existing Permit Limits (tons/year)
	2002 Annual Emissions (tons/year)	2003 Annual Emissions (tons/year)	2004 Annual Emissions (tons/year)	2005 Annual Emissions (tons/year)	2002 Annual Emissions (tons/year)	2003 Annual Emissions (tons/year)			
NOx	28.10	21.08	28.84	34.13	14.17	26.80	18.84	70.71	
CO	12.82	10.36	10.30	0.50	0.53	0.42	0.42	35.4	
SO2	0.27	0.22	0.30	0.53	0.13	0.13	0.13	0.53	
PM	3.43	2.77	3.78	4.42	1.05	4.42	1.05	4.42	
PM-10	3.43	2.77	3.79	4.42	1.05	4.42	1.05	4.42	
VOC	0.56	0.47	0.66	1.22	0.36	0.36	0.36	1.5	

Thermal Oil Heaters

<u>Heater 1 Operations</u>			
2002 Fuel Input (MMscf/year)	2003 Fuel Input (MMscf/year)	2004 Fuel Input (MMscf/year)	Projected Fuel Input (MMscf/year)
106.365	104.180	120.341	179.054

<u>Heater 2 Operations</u>			
2002 Fuel Input (MMscf/year)	2003 Fuel Input (MMscf/year)	2004 Fuel Input (MMscf/year)	Projected Fuel Input (MMscf/year)
124.018	115.845	123.789	158.556

Heater fuel use projections based on maximum heat input capacities identified in 6-30-05 fax from M. Johnson

Emission Factors

Pollutant	Emission Factor (lb/MMscf ^a)
NOx (Heater 1)	50.0
NOx (Heater 2)	100.0
CO	84.0
SO2	0.6
PM	7.6
PM-10	7.6
VOC	5.5

All factors from AP-2 Natural Gas External Combustion

Heater 1 is equipped with low NOx burners, Heater 2 is not, per 6-30-05 email from M. Johnson

Annual Emissions

Pollutant	2002 Annual Emissions (tons/year)	2003 Annual Emissions (tons/year)	2004 Annual Emissions (tons/year)	Projected Annual Emissions (tons/year)
NOx	8.96	8.40	9.20	12.40
CO	9.68	9.24	10.25	14.18
SO2	0.07	0.07	0.07	0.10
PM	0.88	0.84	0.93	1.28
PM-10	0.88	0.84	0.93	1.28
VOC	0.63	0.61	0.67	0.93

Thermal Oil Heaters - Toxic Air Pollutants

<i>Heater 1 Operations</i>		2003 Fuel Input [MMscf/year]		2004 Fuel Input [MMscf/year]		Projected Fuel Input [MMscf/year]					
2002 Fuel Input [MMscf/year]		104,160		120,341		179,054					
106,366		116,345		123,786		186,556					
<i>Heater 2 Operations</i>		2003 Fuel Input [MMscf/year]		2004 Fuel Input [MMscf/year]		Projected Fuel Input [MMscf/year]					
2002 Fuel Input [MMscf/year]		124,016		124,016		124,016					
Heater 1 oil use projections based on maximum heat input capacities identified in 3-30-05 rx from M. Johnson											
<i>Emission Factors</i>											
Pollutant	CAS No.	Emission Factor (lb/MMscf) ^(a)									
Liquid		0.0005									
N ₂ O (Heater 1 - low NO _x)		0.04									
N ₂ O (Heater 2)		2.2									
Methane		2.3									
2-Methylbenzothiophene	81-57-6	2.4E-05									
3-Methylbenzene	56-48-5	1.8E-05									
7,12-Dimethylenbenz(�)anthracene	83-32-9	1.8E-05									
Aceanaphthalene	203-98-8	1.8E-05									
Acenaphthylene	120-12-7	2.4E-05									
Anthracene	58-56-3	1.8E-05									
Benzofluoranthene	71-43-2	2.1E-05									
Benzene	50-32-6	1.2E-06									
Benzol(a)pyrene	205-99-2	1.8E-06									
Benzol(b)fluoranthene	191-24-2	1.2E-06									
Benzol(h)benzene	205-62-3	1.8E-06									
Benzol(k)fluoranthene	198-97-8	2.1E-06									
Butane	216-01-9	1.8E-06									
Chrysene	53-70-3	1.2E-06									
Dibenzol(a,h)anthracene	21521-22-6	1.2E-06									
Dichlorobenzene	74-84-0	3.1E-06									
Ethane	206-44-0	3.0E-06									
Fluorene	86-73-7	2.8E-06									